

## **TESTS AND RESEARCH**

### **Airframe**

The right wing was separated for recovery purposes and contained crush damage to the leading edge about three feet outboard. The fuel tank on the outboard right wing was found full of fluid consistent an odor and appearance of avgas. The right flap remained attached and was physically in the retracted position. About six feet outboard from the wing root, the right wing exhibited crush damage debris was embedded in the wrinkled skin. The wing tip was absent.

The rudder and vertical stabilizer remained intact. The right horizontal stabilizer sustained crush damage to the tip. The left horizontal stabilizer and attached elevator were creased. The left horizontal stabilizer tip was absent.

The nose gear appeared retracted and twisted aft and under the engine. The right main remained in the wheel well.



*Picture 1: Accident Site*

### **Engine**

The engine remained attached to the airframe and mounts with crush damage observed on the firewall. An external visual examination of the engine revealed no evidence of pre mishap catastrophic mechanical malfunction or fire. Damage was noted on the nos. 1 rockerbox cover, where crush deformation was observed. The airbox was disconnected

from the carburetor and scat tubing was disconnecting. The propeller spinner was crushed aft.



*Picture 2: Engine (view from top)*

Initially, investigators were unable to obtain manual rotation of the crankshaft due to crush damage sustained. The ring gear was misaligned and pushed aft against the right side of the engine. Investigators removed the upper spark plugs of all cylinders and three lower (the nos. 4 and 6 lower were not able to be removed due to oil filling the cylinders. According to the Champion Aviation Check-A-Plug AV-27 Chart, these spark plug signatures correspond to normal engine operation although numerous plugs were coated with oil.

The fuel selector was positioned on the left main (30 gal) tank. The fuel selector valve could not be accessed due to the damage sustained to the cockpit. The right outboard tank (15 gal right aux) was full with a fluid consistent in odor and appearance to that of Avgas fuel; the right inboard was fuel with silt and mud.

Investigators removed the fuel line from the gascolator to the electric driven fuel pump and fluid consistent in odor and appearance to that of Avgas dribbled out. The line from the mechanical pump to the carburetor contained fluid consistent in odor and appearance to that of Avgas. The carburetor casing sustained crush damage and it was disconnected from the mount. The carburetor bowl was found empty. The carburetor heat and throttle cables remained attached to their respective arms. The mixture cable was detached. The hardware could not be located and the arm was intact.

During the post recovery examination, the top spark plugs were removed once again. The crankshaft was rotated by hand utilizing the propeller. The crankshaft was free and easy

to rotate in both directions. The complete valve train was observed to operate in proper order, and appeared to be free of any pre-mishap mechanical malfunction. Normal "lift action" was observed at each rocker assembly.

Mechanical continuity was established throughout the rotating group, valve train and accessory section during hand rotation of the crankshaft. "Thumb" compression was observed in proper order on all six cylinders, except Nos. 3 and 5. A subsequent borescope examination of cylinders Nos. 3 and 5 revealed post impact foreign debris had been trapped under the valve seats. Additionally, the combustion chamber of each cylinder was examined through the spark plug holes utilizing a lighted borescope. The combustion chambers remained mechanically undamaged, and there was no evidence of foreign object ingestion (pre-impact) or detonation. The valves were intact and undamaged. There was no evidence of valve to piston face contact observed.

Both magnetos remained securely attached at their respective mounting pads. The ignition harness remained secure at each magneto. The magnetos had been submerged in fresh water at the accident site as stated previously. The left magneto produced an intermittent spark at each post during rotation on the drive utilizing an electric drill. The magneto breaker point cover was removed. The internal compartments and contacts were contaminated with water. The right magneto drive remained intact and undamaged. The right magneto would not produce any spark at the post during rotation on the drive utilizing an electric drill. The magneto breaker point cover was removed. The internal compartments and contacts were contaminated with water.

The three bladed constant speed propeller remained attached at the crankshaft flange. The spinner was attached to the propeller and crushed aft. The propeller blades remained attached to the propeller hub. One of the three propeller blades, one was bent aft about 80 degrees near the blade root. The remaining blades remained undamaged. The propeller governor was securely attached at the mounting pad with the pitch control rod securely attached at the control arm. The governor was removed for examination. The drive was intact and free to hand rotate. The gasket screen was free of visible contamination.

There was no evidence of pre-mishap mechanical malfunctions or failures found during the examination.